survival of *Leptiminus* IV rims could reflect low wine production at *Leptiminus*, or it could simply reflect a higher resistance to breakage. Resistance to breakage is always an important consideration when one is dealing with discarded vessels.

Several general points may be made about amphora production at S290. The workshop manufactured a large variety of forms that carried a variety of food products such as olive oil, fish-products and wine. Naturally this was a response to a known market demand, such as supplying the capital and the army. Although as recently as two decades ago it was difficult to identify the provenance of many of the amphoras found on consumer sites, a clearer image of Tunisian exports is emerging from new publications of Tunisian workshops such as this one, where I have defined 17 types manufactured at *Leptiminus*. The *Leptiminus* excavations have much improved our knowledge of the morphology of Roman Tunisian amphoras, complementing important studies of recent decades.[478] In addition, we should not forget that in many cases an amphora was re-used on consumer sites and the manufacturing date might be much earlier than the context of its deposition.

*Morphology*

In some cases identical amphoras were manufactured not far from *Leptiminus* at *Sullecthum*, *Thapsus* and *Hadrumetum*. I have tried to illustrate the presence of so many variants from the different rim profiles since I consider them to be almost like potters' 'signatures'. This multitude of variants seems to increase in the second and third quarters of the 3rd c. Such similarities in manufacturing, as well as their contemporaneity, can be explained, I would argue, only through the migration of potters between these towns to engage in seasonal contracts. They created a micro-regional *koine* with its own manufacturing peculiarities. As a result, the products of a certain workshop can be distinguished only through the fabric or the stamp (when present); for example, the *Leptiminus* II and IV-VII amphorae seem to be typical of *Leptiminus* and nowhere else.[479] Possibly we can also add the *Leptiminus* VII type, considered by M. Bonifay to be a typical product of this town.[480] These potters created amphoras of a typical Punic tradition, or of a Roman tradition, or with a mixture of Punic and Roman features. The existence of some Spanish and Tripolitanian influences on the manufacture of some amphoras might perhaps also suggest the presence of foreign *figuli* at *Leptiminus* around the middle of the 3rd c.; note that the Spanish Dressel 20 was replaced by much smaller Dressel 23 around this time.[481] Economic problems and unrest in that period perhaps affected the employment of many potters, who were forced to find jobs in less affected places.

The material at S290 has shed light on the morphology of two types that have Punic roots, *Leptiminus* I and II. Debate on the origin of the form of *Leptiminus* I continues. I would argue that it imitates an Iberian form (essentially Punic in its origins), whereas Bonifay proposed that it derives from a local, N Tunisian type,[482] but in either case it remains basically a Punic amphora. These types were very conservative: they were manufactured from the second half of the 1st until the 3rd or even the start of the 4th c. The ubiquity of these types is no surprise when the olive-oil and fish-processing industries had been developed in both N Africa and the Iberian peninsula by Phoenician colonists who had strong expertise in these businesses. This 'Punic underground' continued to exist until Late Roman times, as is evidenced by Punic dipinti on some N African amphoras.[483]

Amphoras of Roman tradition, such as our types III-VII and XIII-XIV, were produced from the last quarter of the 1st until the third quarter of the 3rd c. with only minor morphological changes. The discovery of two amphoras paralleling our types V and VI on the Dramont E wreck of the second quarter of the 5th c. raises the question of the longevity of those types. At any event, these types

478 S. J. Keay 1984; Bonifay 2004; Nacef 2015.
479 Capelli and Bonifay 2016, 546.
480 Bonifay 2004, 117; Capelli and Bonifay 2016, 546.
481 Remesal Rodríguez 1983, 129.
482 Bonifay 2004, 99.
483 Opaiţ 1997-98, 58, no. 32, pl. 12.32.

seem for now to be a typical *Leptiminus* production. An interesting wreck discovered in Croatia was probably loaded at Leptiminus since it included only Leptiminus types III.3.3, V.A.1, VI.A.1, VII.A.2 and VIII.A.2.[484]

The most widely exported type from S290 was *Leptiminus* III/Africana I, which embodies a mixture of Punic and Roman traditions. It proved to be a much earlier creation than had been evident from finds at consumer sites. Its design was probably influenced by local Punic amphoras whose body swells towards the bottom and terminates either in an ogival base or a large knob (*Leptiminus* III.A.2a). I do not exclude that this manner of terminating the lower part of the body in a conical base could be a characteristic feature of *Leptiminus*. The very existence of different types of bases suggests a period of experiment and innovation. We still do not know the date of the first occurrence of this variant, but the body shape would suggest that it slightly predates the classical *Leptiminus* III.A.1/Africana I.A. Still, both variants (III.A.1a and III.A.2a) were used together since they are present in closed contexts, including the service area of our kiln A, the cemetery of *Pupput*,[485] and on the Grado wreck of around the second quarter of the 2nd c.[486] During the second half of the 2nd and at the start of the 3rd c., the shape of the body was slightly modified, to become almost cylindrical, which would be its canonical shape. For a certain period at the start of the 3rd c. both subtypes (III.A and III.B) continued to be manufactured at *Leptiminus*. They are also attested at Ognina off eastern Sicily in the first quarter of the 3rd c.[487] In the second quarter of the 3rd c. and a little later, *Leptiminus* III.C displays a wide variety of rims, perhaps heralding a change to a new type, *Leptiminus* VIII, the so-called cylindrical containers of the Late Empire. *Leptiminus* IX occurs only in the workshop area and not among the discarded pieces inside the abandoned kilns, which might suggest a slightly later date of production (perhaps in the third or fourth quarter of the 3rd c.) in a different kiln, still unidentified.

During the 3rd c., modifications occurred in the morphology of *Leptiminus* type III/Africana I and the series known as Africana II commenced. The discoveries at S290 indicate that the main types manufactured at this workshop were *Leptiminus* VII/Africana II.D, *Leptiminus* X/Africana II.B and *Leptiminus* XI/Africana II.A. *Leptiminus* XV/Africana II.C has an erratic presence at this site, and *Leptiminus* XIII, XVI and XVII also appear only in modest quantities. *Leptiminus* XII is of special interest as it appears to have a strong morphological relationship with certain Tripolitanian II amphoras, but there are no fully preserved amphoras of this type. Rims of *Leptiminus* XVI imitate Mauretanian or Gallic types (Dressel 30).

*Amphora capacities*

With respect to the capacity of amphoras found at S290, one must stress that the present typology is based mainly on rims: only a few amphoras with a full profile were preserved. Therefore in most cases I used parallels found elsewhere to draw conclusions about volume. I also considered that, for the most part, large rim diameters reflect large capacities, whereas small rim diameters correspond to small capacities. This proved to be correct when, in some cases, it was possible to find upper bodies, but in some isolated instances when the rim was extremely everted it created a misleadingly big rim diameter that did not always correspond to a large maximum diameter.

It was seldom possible to measure the capacity of *Leptiminus* amphoras with water or sand, as only two complete jars have been found. In some cases, however, it was possible totally or partially to mend amphoras and to reconstruct them in drawings. When even that approach was not possible, I calculated the volumes of complete vessels discovered at other sites.[488] As a result, interesting (if tentative) observations can be made for most of the types. For example, the jars of Punic origin,

484 Pešić 2017, figs. 2.2, 2.1, 3, 2.6 and 2.5.
485 Bonifay 2004, 103, type 16.
486 Auriemma 2000, 38.
487 Kapitän 1972; Kapitän and Price 1974; Manacorda 1977, 157.
488 Some amphora capacities were calculated by B. Grigoraş.

type I and II, were manufactured in three modular sizes.

I The intact amphora of type I has a capacity of *c*.28 litres, but since amphoras of larger and smaller rim diameters have been discovered I think that the basic module was 26 litres.

II The complete amphora of type II has a maximum capacity of *c*.15.5 litres, whereas an amphora of this form discovered at Marseille holds *c*.27 litres. Again, the basic module appears to have been 26 litres, with the *Leptiminus* jar probably holding half an amphora, that is, 1 urn (13.13 litres). It may be that this was the size unit in use for transporting *garum*.

III For type III, volume was analyzed only for subtypes A1 and A2. It seems again that these amphoras were produced in different sizes. A complete amphora found in the service area of kiln D was one of the largest examples, with a volume of *c*.64.5 litres, but other unmendable fragments of upper bodies suggest that even larger capacities existed. Amphoras of the "*tipo largo*", with maximum diameter of 33 cm, found on the Grado wreck had a smaller volume at *c*.43-44 litres.[489] Another variant found on that wreck had a diameter of only 28-29.5 cm, suggesting a still smaller capacity.[490] Perhaps these volumes reflect the ancient weight unit *metretes* (39.39 litres). Type III was probably used for olive oil, whose weight is 0.9 that of water or wine. The maximum capacity found among the Grado examples was 44 litres. Multiplying this by 0.9, we obtain a value of 39.39 kg, representing the weight equivalent of 1 *metretes*.[491] Of course, this is simply a working hypothesis that needs confirmation from dipinti of commercial notations.

IV-VI Types IV, V and VI are difficult to analyze as they were not widely exported and only a few complete examples are known. For type VI, there appear to be two modular sizes: 42 and 64 litres.

VII-IX Type VII/Africana II.D, extensively exported, is known both in Tunisia and on the consumer sites of the N shores of the Mediterranean. It was made in two different sizes, mostly ranging between 34 and 68 litres. They are likely to be the equivalent of the measures *kentenariuam* (95-100 lbs or 31.1-32.7 kg = 34.2-36 litres of oil) and *amphora gemellaria* (twin amphora) (216 lb or 70.6 kg = 77.7 litres of oil) frequently mentioned on ostraca.[492] Although most exports of *Leptiminus* VIIA/Africana II.D were of this large size, smaller jars of 49, 45 and 34 litres are known; they perhaps constitute the transition to the reduced dimensions of the late cylindrical amphoras of *Leptiminus* types VIII and IX, whose capacities vary between 26.5 and 32.5 or 35 litres. These reduced variations seem to suggest an increase in standardization among these types starting in the second half of the 3rd c.

X-XI Types X and XI/Africana II.B and II.A are well known both in Tunisia and on consumer sites with capacities around 49, 52, 65, 79 and 107 litres. The variations within these two types became more accentuated during the 3rd c. Type XI also seems to belong to the large size with a capacity of 83.6 litres.

XII Type XII, influenced by Tripolitanian examples in its morphology and general proportions, also appears to belong to this group of large amphoras.

XIII-XIV Types XIII and XIV are olive-oil amphoras again made in two modular sizes of 35-40 and 108 litres.

XV Type XV is an amphora of considerable volume, varying from 28 to 71 litres. In the case of olive-oil amphoras, I suggest that more care was taken to create more or less standard amphoras.

In general, we should note that the amphoras of the Punic tradition appear to have been manufactured according to Roman units of volume. For the most part, the amphoras that were more

489 Auriemma 1997, 130.
490 Ibid.
491 Hultsch 1971, 702, Table IX.
492 Peña 1998, 171.

extensively exported have a wider range of fractional sizes. It is not clear, however, why type III/Africana I.A is mainly found in the small sizes on consumer sites when it plainly was sometimes manufactured in much larger sizes. Was there was a preference for exporting the smaller size, or does the situation simply reflects the chance nature of discoveries?

*Amphora contents*

For the contents of amphoras manufactured at S290, there is no direct information as these jars did not have a chance to be used, but aspects of their design and parallels with amphoras discovered at other sites give us some hints. The workshop at S290 made containers for three main African exports: *garum,* olive oil and wine.

(i) Garum

Types I and II must have carried *garum* as they have a hollow spike designed to collect the dregs.[493] Given that the lower end of an amphora is the part most exposed to physical shock, it does not make sense to make such a fragile foot unless it was meant to serve a specific function. Some jars of type III A/Africana I.A that have a hollow toe may have carried *garum* too.[494] Probably types V, VI, XI and XV/Africana II.C held similar contents.

(ii) Olive oil

Type III/Africana I was probably the main container for olive oil.[495] The manufacture of the other types (*Leptiminus* XIII/Ostia LIX, *Leptiminus* XIV/Pseudo Tripolitanian and *Leptiminus* XVII/Ostia XXIII) starting in the second half of the 1st c., albeit in modest quantities, hints at the importance of this industry at *Leptiminus*, but the real boom seems to start only with the creation of type III.A/Africana I.A, most likely during the reign of Hadrian.

(iii) Wine

Wine was exported in amphoras of type IV and XVI, which appear to imitate certain well-known wine amphoras. I would tentatively add types VIII and IX to this wine-bearing group since they seem to represent the beginnings of the first phase of the cylindrical vessels of the Late Empire that are thought to have carried wine.[496] These new types support the literary and epigraphic texts.[497] They confirm the existence of a wine (*passum*?), with a long tradition since Punic times; Pliny (*NH* 14.81) calls it *Africum* and considers it inferior only to the Cretan *passum*.[498] Its export probably started in the 1st or early 2nd c.[499] Here we should not forget *L. Caecilius Aemilianus*, a *decurio* and *duumvir* of *Aelia Uluzibbira*, a town 50 km north of *Leptiminus*, who was a member of an association *vinariorum inportatorum negotiantium* at Ostia.[500] Nonetheless, we require further confirmation of the contents of these amphora types.

*Stamps*

Forty-three stamps, mostly fragmentary, were found at S290. The type and variant of the amphora could be identified for all but two. An earlier presentation of all *Leptiminus* stamps found at both *Leptiminus* and export sites provided in-depth discussion.[501] Here I will only point out that stamps occur mainly on a few types: *Leptiminus* III C/Africana I.B, *Leptiminus* VII/Africana II.D, *Leptiminus* VIII, *Leptiminus* X/Africana II.B, *Leptiminus* XI/Africana II.A and *Leptiminus* XV/Keay

493 Note that a spike matching *Leptiminus* type I was found full of fish remains at El Jem (Bonifay *et al.* 2002-3, 175, fig. 20.289).
494 For instance Bonifay 2004, 100, fig. 53, type 14 nos. 2 and 4; Zevi and Tchernia 1969, 208, fig. 22b.
495 Bonifay 2007a, 19.
496 Bonifay 2004, 122; Woodworth *et al.* 2015.
497 Lequément 1980; Brun 2004, 200-2.
498 Columella (*Rust.* 12.39.1-4) attributes one of his recipes for *passum* to the Carthaginian author Mago; see Dalby 2003, 250.
499 Dalby 2003, 357.
500 *AE* 1940, 64. Bloch 1939, 37-40; Lequément 1980, 189.
501 *Leptiminus* 3, 352-86.

Vbis/Bonifay 2. Site 290 yielded no stamped examples of *Leptiminus* I and II, IV-VI, IX, XII and XIII-XVII.[502]

The rich collection of stamps found at S290 sheds new light on the internal organization of one workshop within the large production centre of *Leptiminus*. Around the second quarter of the 3rd c. this workshop may have belonged to a *Rosarius*, who was perhaps commissioned with supervising amphora production or with bottling the contents by the town or by the *Regio Leptiminensis*.[503] It is not excluded that *Vincentius* succeeded him around the middle of the 3rd c.

Site 290 was not the only pottery production site at *Leptiminus*, several others having been identified in the field survey through the surface presence of pottery wasters and kiln brick.[504] *Leptiminus* was an important collecting point not only of foodstuffs from private landlords but also from the imperial *latifundia*. One hopes that further investigation of pottery workshops at *Leptiminus* will take place.

It is worth noting that, beginning in the second quarter of the 3rd c., there is an increase in amphora variants (I.D.1-4, II.C.1-4, III.D.1-7, VII.A.1a-d, VIII). Can this multiplicity of variants, which suggests an increased number of different potters, be correlated with the increased occurrence of stamps on some amphoras as a means to control and guarantee the quality of the vessels?

*The circulation of these products*

The widespread circulation of these N African products is shown by the parallel finds stretching from Britain to Yemen. Of course, in the absence of fabric analyses it is difficult to associate these finds only with products of *Leptiminus* (types III.A.2, VII.A.2, XIII.A.1, XV) but it is reasonable to assume that they originate in the neighbourhood of *Sullecthum*, *Leptiminus* and *Hadrumetum*. It is also worth drawing attention to the presence of shipwrecks which carried only *Leptiminus* amphorae at Giglio Porto[505] and Babuljaš.[506] Very probably these ships were involved in the so-called "direct trade" between different emporia, because their cargo seems to have been quite consistent with the *Leptiminus* amphora.[507] However, the cargo found on the Cnidos shipwreck is quite varied and probably reflects cabotage trade.[508] The cargoes of shipwrecks Cabrera III and Levanzo I are likewise varied.[509] Their presence in Qana' might suggest that some were on their way to the E coast of Africa and as far away as India. Note also that towards the third quarter of the 3rd c., *Leptiminus* amphorae appear in Spain, a region that itself supplied olive oil and fish products to almost the entire western part of the empire. Could the timing be a result of an economic crisis in the more westerly provinces?

The excavation at S290 has considerably enlarged our knowledge of N African amphora shapes, bringing to light new types and variants such as types I, II, IV-VI, XII, XVI and XVII. The publication of this material will help archaeologists working on consumer sites more easily to identify their material and assign it to *Leptiminus* as appropriate. We now understand better the different variants and capacities of some well-known types such as *Leptiminus* III/Africana I, *Leptiminus* VII/Africana II.D, *Leptiminus* VIII and *Leptiminus* IX, which are the predecessors of the cylindrical vessels of the Late Empire. The excavation has refined our knowledge of particular *Leptiminus* amphoras specially designed for *garum* (types I and II), olive oil (III, XIII, XIV and XVII) and wine (IV and XVI), even if many questions concerning amphora contents still remain.

Jane Heinrichs, Bianca Grigoraş, Sarah Chartrand and Iuliana Barnea kindly prepared images for this chapter.

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502 A rare stamp appeared on an amphora matching our Type XIII at Monte Testaccio (Remesal Rodríguez 2007, 211, no. 598, dated 254), but I do not know whether this amphora was made at *Leptiminus*.

503 Crawford 1976, 58

504 *Leptiminus* 3, 224-28 and figs. 6.14-15.

505 Bonifay 2007b, 256.

506 Pešić 2017.

507 Rice 2016 with bibliography.

508 Opaiţ *et al.* forthcoming.

509 Bost *et al.* 1992, 137-44, figs. 35-39 (Cabrera III); Royal and Tusa 2012, 36.